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Revisiting the snakes of Bangladesh: a systematic review of species diversity and distribution patterns

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Abstract

Bangladesh is a country of rich biodiversity, including herpetofauna, across diverse ecosystems. This study reviews snake diversity and distribution patterns in Bangladesh, identifying 141 species in the existing literature. However, we confirmed the presence of 89 species based on documentation in literature, research-grade data in online repositories, and verified photographs on social media. Among them, the family Colubridae comprises 35%, followed by Elapidae (26%), Natricidae (13%), and others. Regarding envenomations, 70% of the species are non-venomous and 30% are venomous. Three species (*Acrochordus granulatus*, *Boiga westermanni*, and *Dieurostus dussumieri*) were considered regionally extinct in the absence of sightings in the past five decades. Sixteen species were deleted due to unreliable reports or misidentifications, while *Ahaetulla sahyadrensis* and *Rhabdophis helleri* were added. Additionally, we hypothesize that 33 species may inhabit Bangladesh, considering their ecological distribution. We illustrated the geographical distribution patterns of confirmed species using kernel density estimation (KDE), identifying the mixed evergreen forests in the southeast and northeast and the mangrove forests in the southwest as densely populated habitats. This study enhances the understanding of snake diversity and distribution in Bangladesh and underscores the need for further research and conservation efforts to prevent species extinction.

Key Words

checklist, Chittagong Hill Tracts, conservation efforts, herpetofauna, kernel density estimation, Sundarbans, zoogeography

Introduction

Bangladesh is a South Asian country that occupies an area of about 147,570 km², located along the Bay of Bengal to the south, with India to the west, north, and east, and Myanmar to the southeast (Rashid 2019). The country is characterized by a predominantly low-lying landscape with vast floodplains, lakes, marshlands, and the lower delta of crisscrossing rivers (e.g., Padma, Meghna, and Jamuna) and estuaries, making it the largest river delta in the world (Chowdhury et al. 2022). The country's topography is mostly flat, with extensive waterways and coastal areas, including the Sundarbans, the world's largest mangrove forest (Rogers and Goodbred 2014). The terrestrial habitats in Bangladesh include the evergreen forest of the Chittagong Hill Tracts in the southeastern part featuring hilly terrain, mixed evergreen low hill forest patches in the northeast (Sylhet) and northern

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(Mymensingh) regions, moist deciduous forests in the central and northwest regions, and the mangrove forest, the Sundarbans, in the southwest (Reza et al. 2019). In addition, bushy, grassy, and bamboo-dominated unclassified state forests, or classified forest patches, namely *Kunjaban* at plains and *Paraban* at hill tracts, as well as homestead vegetation, make up the diverse terrestrial habitat (Alam 2011). Except for some wide rivers, there are no dominant physical barriers across the country—that is why it serves as a connecting bridge for the faunal diversity of the Indo-Burma hotspot, the Gangetic plains, and the Deccan plateau (Chandra and Gupta 2022).

The first systematic research on the wildlife in this region was initiated by Sir William Jones (1746–1794) in the 18th century, while herpetological research began with the collection of type specimens for the museum of the Asiatic Society of Bengal by Theodore Edward Cantor (1809–1860) and John MacClelland (1805–1875) during the British colonial period in the early 19th century (Das et al. 1998). Later, Edward Frederick Kelaart (1819–1860), Colonel Arthur Purves Phayre (1812–1885), Brian Houghton Hodgson (1800–1894), William Lutley Sclater (1863–1944), and Sunder Lai Hora (1895–1955) also made noteworthy contributions to herpetological research by collecting type specimens from British India, including Bengal (Mahendra 1935; Das et al. 1998). In addition to the collection and curation of specimens, Edward Blyth (1853), Thomas Claverhill Jerdon (1853, 1870), Albert C. Günther (1864), William Theobald (1868, 1876), Ferdinand Stoliczka (1870, 1872), William Thomas Blanford (1870, 1878, 1890, 1898, 1901), John Anderson (1871), George-Albert Boulenger (1890, 1893), William L. Sclater (1891), Alfred Alcock (1896), Frank Finn (1896), Nelson Annandale (1904, 1905, 1912), Captain Frank Wall (1906), and Malcolm Arthur Smith (1943) made significant contributions to herpetology by publishing formal works on the reptiles (including snakes) of British India (Mahendra 1935). In those references, "Bengal" was frequently designated as the type locality for reptilian species, creating ambiguity about whether the species' range lies within the current political borders of Bangladesh or the neighboring West Bengal state of India.

In present-day Bangladesh, numerous studies have significantly contributed to our understanding of snake diversity over the years, with several comprehensive lists compiled by various researchers. Montaquim et al. (1980) were among the first to document the region's snake diversity, listing 28 species. This was followed by Khan (1982), who compiled a checklist of 78 species. Subsequent studies by Sarker and Sarker (1985) and Khan (1987) further expanded the list, reporting 72 and 79 species, respectively. Over the following years, more detailed research was conducted by Sarker and Sarker (1988), noting 88 species in a book on wildlife. Khan (1992) accumulated 81 species in a Bengali book on snakes, and Ahsan (1996) presented a list of 77 species at a conference. As research progressed into the 21st century, the number of reported species grew substantially. In 2007, Asmat and Hannan (2007) compiled a checklist of 94 species, while Khan (2008) reported 98 species in a field guide. Kabir et al. (2009) compiled a list of 91 species in the encyclopedia of country fauna. Khan (2010) produced a checklist of 94 species and again compiled a list of 106 species in a field guide in 2015 (Khan 2015). Recently, Khan (2018) provided a list of 105 species in a photographic guide. Besides these reports, IUCN Bangladesh assessed the conservation status of 28 species in 2000 and 100 species in 2015 as part of the Red Listing program (IUCN Bangladesh 2000, 2015). However, these studies exhibit inconsistencies both in the reported taxa and in the number of species. These discrepancies may arise from differences in research methodologies applied during taxonomic revisions. Such inconsistencies create confusion among herpetologists, snake rescuers, conservation activists, snakebite-related health care providers, and policymakers by complicating the understanding of snake diversity in the country.

Besides the above country checklists, several studies have explored regional snake diversity in Bangladesh. Notable contributions include research on wildlife, including snakes, in the mangrove ecosystem (Khan 1986), coastal wildlife (Sohrab and Sarker 1986; Sarker and Hossain 1997), and herpetofauna in the Chittagong Hill Tracts (Mahony and Reza 2008). Other significant studies have focused on cataloging amphibians and reptiles at the zoological museum of Jahangirnagar University (Mahony et al. 2009), examining the herpeto-mammalian fauna of the Padma River (Rahman et al. 2012), studying snake activity patterns in Lawachara National Park (Rahman et al. 2013), and documenting snake abundance at Rangpur Carmichael College (Kabir 2013). Additional research has explored the herpetofauna of Baraiyadhala National Park (Karim and Ahsan 2014), snake diversity at the Chittagong University campus (Ahsan et al. 2015), and bycatch sea snakes in Cox's Bazar (Sarker et al. 2017). More recent studies have focused on the diversity of herpetofauna in Lawachara and Nijhum Dwip National Parks (Hakim et al. 2020; Rabbe et al. 2022) as well as wildlife diversity in the northern deciduous forests (Jaman et al. 2023).

At the beginning of the 21st century, several publications described new country records of snake species from Bangladesh. Notable examples include the documentation of *Ptyas korros* (Ahsan and Parvin 2001), *Boiga ochracea* (Ahsan and Parvin 2004), *Lycodon zawi* (Reza 2010a), *Oligodon albocinctus* (Hasan et al. 2013), *Sinomicrurus macclellandi* (Rahman et al. 2017), *Psammophis condanarus* (Haidar et al. 2020), *Hydrophis lapemoides* (Chowdhury et al. 2021), *Oligodon kheriensis* (Romon et al. 2021), *Fowlea schnurrenbergeri* (Mahamud et al. 2022), *Hydrophis stricticollis* and *H. obscurus* (Sarker et al. 2023), and *Smithophis atemporalis* (Mahamud et al. 2023).

Being cold-blooded, slithering animals, snakes are an integral part of culture, religious beliefs, mythos, folklore, and superstitions in this region, often resulting in

snake–human conflicts. This conflict is bipartite: the intentional or unintentional killing of snakes by humans and snakebite envenoming causing human deaths. To focus on the first aspect, several studies have been conducted on the anthropogenic impacts on snakes (Quamruzzaman et al. 2016; Datta et al. 2018; Rabbe et al. 2021), the traditional practice of snake charming (Karim 1988; Ahmed et al. 2013; Kabir 2018), the behavioral ecology of snakes (Shihan and Kabir 2015; Moktadir and Hasan 2016), and the habitat utilization patterns and distribution of snakes across this tropical country (Chowdhury et al. 2011; Rahman et al. 2013; Shome and Jaman 2021; Haidar et al. 2023; Hasan et al. 2025). Focusing on the second aspect, several studies have also been conducted to understand the dynamics of snakebite, which is a significant concern in rural Bangladesh (Rahman et al. 2010; Rashid et al. 2022; Ghose et al. 2023). Among these, the clinical management of snakebites in Bangladesh has been extensively studied in the last few decades (Faiz et al. 2010; Mondal et al. 2012; Hasan et al. 2016; Haidar et al. 2023; Chowdhury et al. 2024a). This also includes multiple studies on the proteomic analysis of snake venom of native venomous species (Pla et al. 2019; Alam et al. 2023; Haidar et al. 2024) and the efficacy of antivenoms in preclinical and clinical settings (Faiz et al. 2017; Deka et al. 2019). Researchers have also carried out studies on the genomics and molecular taxonomy of snakes in the country (Kundu et al. 2020; Islam et al. 2022). Along with the literature on the diversity and new distribution records of snakes, these publications also provide valuable insights into the country's snake diversity and distribution over time.

In modern information flow, online databases such as GBIF, iNaturalist, and IUCN portals are invaluable tools for studying snake diversity (Uetz et al. 2025). In recent times, the use of smart mobile devices and access to social media have also played a significant role in studying snake diversity, as people from every corner of the country regularly post photos and occurrence information of snakes. With proper scrutiny, these vast sources of information can be used for scientific research (Marshall and Strine 2019), including biodiversity studies (Chowdhury et al. 2024b). Additionally, records in the country's institutional museums provide valuable information on snake distribution and play a crucial role in understanding snake diversity (Guedes et al. 2020). Including all the aforementioned sources, we conducted a systematic review through an extensive survey of literature on snake diversity and distribution, new records, habits, habitat ecology, human perceptions, snake charming traditions, snake genomics and proteomics, venomics and antivenomics, and snakebites and their management. This review also outsourced information from scientific publications, online repositories, and social media to decide the confirmation, elimination, and anticipation of the occurrence of snake species, ultimately creating a comprehensive confirmed list of snake species in the country. We also estimated the species richness, population density, and geographical distribution patterns of snakes in Bangladesh.

Methods

A systematic review is a critical analysis that combines secondary information from published sources with primary data generated through reproducible methods (Pollock and Berge 2018). This review critically analyzed published references, obtained research-grade data from authentic online repositories (Saran et al. 2022), and incorporated data from social media after cross-verification (Chowdhury et al. 2024b) to confirm species occurrence and compile a comprehensive list of snakes in the country.

Literature survey

We used nine sets of keywords to search the literature on Google Scholar and Web of Knowledge. These keywords were selected with a focus on snakes plus their localities, major habitats, behaviors, distribution, traditional practices related to snake charming, genomics, snakebites, and clinical management. The sets were as follows:

Set A: snake, sea snake, herpetofauna, reptiles, Reptilia, wildlife, biodiversity, biota
Set B: Bengal, Bangladesh, Dhaka, Chittagong, Sylhet, Rajshahi, Rangpur, Mymensingh, Khulna, Barishal, Sundarbans, Hill Tracts
Set C: forest, tropical forest, mangrove, deciduous forest, wildlife sanctuary, national park, ecopark, coastal, campus, museum
Set D: habit, behavior, habitat, niche, composition, assemblage, distribution, diversity
Set E: Bede, Bedey, charmer, shaman, shamanism
Set F: first record, new record, new distribution, confirmed record, country report, new species, rediscovery
Set G: molecular, genetics, gene, genome, DNA, phylogenetics
Set H: snakebite, venom, antivenom, envenoming, envenomation
Set I: health, medical, clinical, treatment, epidemiology

We conducted literature searches by combining keywords from different sets in various ways. For example, we combined a keyword from Set A with a keyword from Set B, Set A with Set C, Set A with Set D, Set A with Set E, Set A with Set F, and Set B with Set H. Additionally, we used combinations of keywords from three sets, such as A, B, and C; A, B, and D; A, B, and F; A, B, and G; as well as B, H, and I.

We found a total of 227 publications on the snakes of Bangladesh, published between 1853 and 2024 (Suppl. material 1). These included 190 research articles, 31 books or book chapters, two conference proceedings, and four institutional reports. From these sources, we extracted information on snake taxa along with the most precise locality data within Bangladesh.

Collections of species occurrence data

Besides scholarly research publications, spatial data on snake occurrences in Bangladesh were collected from the Reptile Database (Uetz et al. 2025) and the IUCN Red List of Threatened Species in Bangladesh (IUCN Bangladesh 2015). Research-grade and verifiable data were retrieved from renowned online repositories such as GBIF, iNaturalist, and the IUCN portal. The locations of snake species were also obtained based on DNA sequencing data of snake taxa from Bangladesh available in the NCBI database. Additionally, we collected distributional data from electronic, print, and other online social media sources using the same combination of keywords applied in the literature survey. Of the social media sources, we prioritized Facebook-based groups led by academic personnel and dedicated to snake rescue, public awareness, and species conservation in Bangladesh. To ensure accuracy, the data from these online sources were verified by cross-checking posted specimen photos and their corresponding locations individually. All occurrence data were systematically organized and stored species-wise in separate files for analysis.

Species compilation and categorization

After the above-mentioned systematic review, we classified the snakes of Bangladesh into four categories: confirmed, regionally extinct, deleted, and expected species. The presence of species in the country was confirmed through specimen-based records in the literature, research-grade occurrence data in online repositories, or photographic documentation on social media, with cross-verification of species identification and locality information. Species without documentation or confirmed sightings in the past 5 decades were considered regionally extinct in Bangladesh. We excluded certain species due to misidentification or in light of recent taxonomic revisions. The remaining species were anticipated to occur in the country based on their ecological and geographical distribution in neighboring countries. The classified species were listed and organized according to the classification system proposed by Mark O'Shea (O'Shea 2023). Further, snakes were categorized into two groups based on the presence of venom and its intensity: non-venomous species lack venom, while venomous snakes have potent venom contained in well-structured glands and delivered by fangs that induce bites potentially lethal to humans (Leviton et al. 2008). Additionally, we included information on the distribution of snakes and their habitat utilization within the list. We used the terms southeast, northeast, east-central, west-central, north-central, south-central, north, northwest, and southwest regions to describe the distribution of snakes across the country, referring to the administrative divisions: Chattogram, Sylhet, and Dhaka (east bank of the Padma River); Dhaka (west side of the Padma River); Mymensingh; Barishal; Rangpur; Rajshahi; and Khulna, respectively.

Species richness analysis

To map the species richness of snakes in Bangladesh, occurrence data from multiple CSV files were aggregated into a single spatial dataset, with species identities derived from the file names. The geographic boundary of Bangladesh was obtained from the GADM database (Setiawan and Sediyono 2020) and used to create a high-resolution raster template with a 0.02° grid. Occurrence points were rasterized to count unique species per grid cell, masked to the boundaries of Bangladesh. The resulting raster was smoothed using a Gaussian filter to blend spatial patterns (Silverman 2018) and visualized using ggplot2 (Villanueva and Chen 2019).

Distribution probability analysis

The probability of snake occurrences in Bangladesh was analyzed to estimate habitat utilization patterns employing kernel density estimation (KDE) using the kde2d function (Venables and Springer 2002). KDE is a non-parametric approach that estimates the probability density function of spatial occurrence points, smoothing their distribution to produce a continuous density surface that highlights patterns of species presence (Venables and Springer 2002). For this, snake occurrence data from Bangladesh were processed into a spatial format, and the country's administrative boundary was also sourced from the GADM database. The KDE output was converted into a raster, then cropped and masked to conform to the geographic boundary of Bangladesh. This probability raster was transformed into a data frame and visualized using the ggplot2 package to present the distribution and habitat utilization patterns (Villanueva and Chen 2019).

Results

Species diversity

Our systematic review of the existing literature on ophidian biodiversity in Bangladesh listed a total of 141 snake species. Upon further cross-verification, we confirmed that 89 species from 13 different families are present in the country (Fig. 1A, C, Table 1). Additionally, three species are considered regionally extinct (Table 2), 16 species have been removed from the list (Table 3), and 33 species are anticipated to potentially inhabit Bangladesh (Table 4) based on their existing global distribution and habitat use patterns (Fig. 1A).

Non-venomous snakes account for 70% of the total confirmed snake species in Bangladesh, while venomous species account for 30% (Fig. 1B). The venomous species are predominantly from the family Elapidae, which represents 25.8% (23 species) of the total species composition. Within this family, 10 species are terrestrial, belonging to the subfamily Elapinae, which includes five kraits, two coral snakes, two true cobras, and one king cobra. The remaining 13 venomous species of the Elapidae are marine snakes under the subfamily Hydrophiinae.

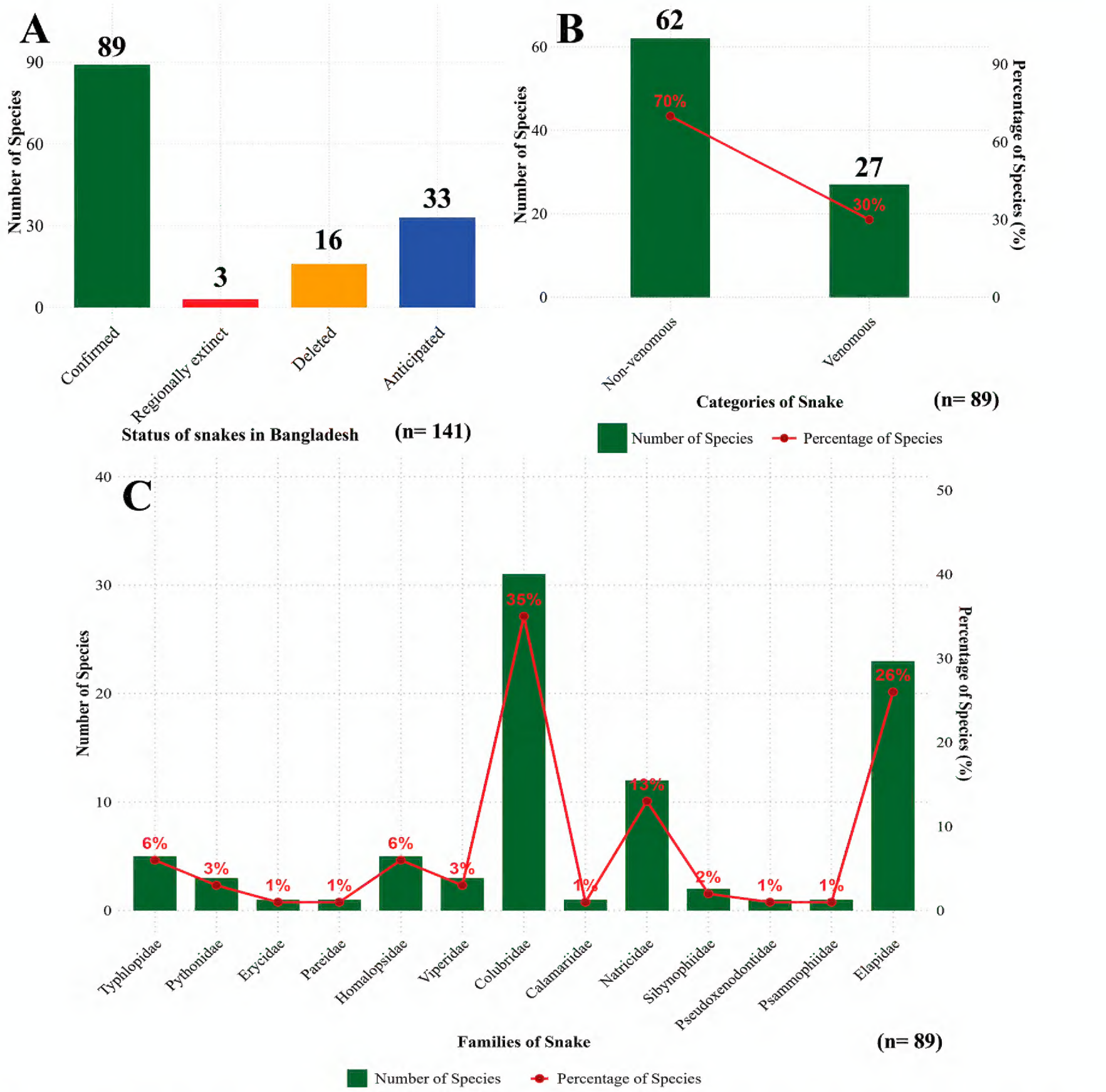

Figure 1. An overview of snake diversity in Bangladesh. **A.** The present state of snake species in Bangladesh includes those that are confirmed, regionally extinct, deleted, and anticipated to exist; **B.** The numbers and proportions of venomous and non-venomous snakes, emphasizing the overall variety of snakes; **C.** Snake families in Bangladesh with the number of representative species.

Additionally, the family Viperidae contributes 3.4% (3 species) to the venomous species count. Furthermore, *Rhabdophis helleri*, which belongs to the family Natricidae, is the lone species in the country that is considered venomous as well as a true poisonous snake.

Among the 13 families of snakes in Bangladesh, Colubridae is the largest group in terms of species diversity, comprising 35% (31 species) of the total confirmed species. This is followed by Elapidae and Natricidae, which contribute notably to the overall snake diversity, representing 25.8% and 13.5% of the total species, respectively (Fig. 1C). Families such as Typhlopidae and Homalopsidae each contribute 5.6% (5 species), while Pythonidae and Viperidae each contribute 3.4% (3 species) to the overall species count. Less-represented families such as Erycidae, Pareidae, Calamariidae, Pseudoxenodontidae, and Psammophiidae each account for 1.1% (1 species) of the total species (Fig. 1C).

Based on available documentation or sightings over the past five decades, three snake species have been considered regionally extinct in Bangladesh (Table 2). Moreover, 16 species have been deleted from the country's list of ophidian fauna due to the absence of specimen records, specimen-based taxonomic descriptions, confirmed sightings, or subsequent taxonomic revisions (Table 3). Additionally, 33 species have been included in the reviewed literature without specimen-based documentation or confirmed sightings (Table 4). Considering their global distribution patterns, these species have now been placed on a separate list anticipating their potential occurrence within the country's territory (Fig. 1A). Most of these species belong to the family Colubridae (n = 11), followed by Natricidae (n = 10), Viperidae (n = 4), and Elapidae (n = 4). Meanwhile, the families Typhlopidae, Xenodermidae, Pareidae, and Homalopsidae each comprise one species.

Table 1. List of confirmed snake species of Bangladesh with geographical distribution and habitat utilization.

SL	Scientific name	Common name	Distribution	Habitat preference
Family: Typhlopidae				
1	*Argyrophis diardii* Schlegel, 1839	Diard's blind snake	Southeast, northeast, and east-central	Forests and well-vegetated areas
2	*Indotyphlops albiceps* (Boulenger, 1898)	White-headed blind snake	East-central and southwest	Moist areas of homestead vegetation
3	*Indotyphlops braminus* (Daudin, 1803)	Brahminy blind snake	Countrywide	Damp hiding in the mangroves, tropical forests, urban, agricultural, and vegetated areas
4	*Indotyphlops jerdoni* (Boulenger, 1890)	Jerdon's worm snake	Southeast	Tropical forests
5	*Indotyphlops porrectus* (Stoliczka, 1871)	Slender worm snake	Southeast, northeast, east-central, north, and southwest	Forests and well-vegetated areas
Family: Pythonidae				
6	*Malayopython reticulatus* (Schneider, 1801)	Reticulated Python	Southeast and northeast	Mixed evergreen forests
7	*Python bivittatus* Kuhl, 1820	Burmese Python	Southeast, northeast, east-central, north-central, south-central, and southwest	Forests and well-vegetated areas
8	*Python molurus* (Linnaeus, 1758)	Rock Python	East-central, north-central, south-central, north, and southwest	Forests and well-vegetated areas
Family: Erycidae				
9	*Eryx conicus* (Schneider, 1801)	Common Sand Boa	North, north-western, west-central, east-central, and southwest	Sandy river banks
Family: Pareidae				
10	*Pareas monticola* (Cantor, 1839)	Common slug snake	Southeast and northeast	Mixed evergreen forests
Family: Homalopsidae				
11	*Cerberus rynchops* (Schneider, 1799)	Dog-faced water snake	Southeast, south-central, and southwest	Coastal wetlands
12	*Enhydris enhydris* (Schneider, 1799)	Rainbow water snake	All over the country	Swamps, marshes, and wetlands, including agricultural fields, rivers, canals, and ditches
13	*Ferania sieboldii* (Schlegel, 1837)	Siebold's mud snake	North, north-central, southeast, northeast	Freshwater wetlands
14	*Fordonia leucobalia* (Schlegel, 1837)	Crab-eating water snake	Southeast and southwest	Mangrove wetlands
15	*Gerarda prevostiana* (Eydoux & Gervais, 1837)	Glossy marsh snake	Southeast, south-central, and southwest	Mangrove wetlands
Family: Viperidae				
16	*Daboia russelii* (Shaw & Nodder, 1797)	Russell's viper	Northwest, southwest, west-central, east-central, south-central, and southeast	Grassy plainlands, croplands, riversides, and homestead areas
17	*Trimeresurus erythrurus* (Cantor, 1839)	Spot-tailed green pit viper	Southeast, northeast, south-central, and southwest	Mixed evergreen and mangrove forests
18	*Trimeresurus popeiorum* Smith, 1937	Pope's green pit viper	Southeast	Mixed evergreen forests
Family: Colubridae				
19	*Argyrogena fasciolata (Shaw, 1802)*	Banded racer	Northwest, west-central, and southwest	Low plain lands
20	*Ahaetulla anomala* (Annandale, 1906)	Anomala Vine Snake	North, northwest, east-central, south-central, and southwest	Well-vegetated areas
21	*Ahaetulla prasina* (Boie, 1827)	Short-nosed vine snake	Southeast, northeast, east-central, south-central, and southwest	Forests and well-vegetated areas
22	*Ahaetulla sahyadrensis* Mallik et al., 2020	Brown Vine Snake	Southwest	Mangrove forests
23	*Boiga cyanea* (Duméril et al., 1854)	Green cat snake	Southeast, northeast, and southwest	Mixed evergreen and mangrove forests
24	*Boiga gocool* (Gray, 1834)	Eastern cat snake	Southeast, northeast, and north-central	Mixed evergreen forests
25	*Boiga multomaculata* (Boie, 1827)	Many-spotted cat snake	Southeast and northeast	Mixed evergreen forests
26	*Boiga ochracea* (Theobald, 1868)	Tawny cat snake	Southeast and northeast	Mixed evergreen forests
27	*Boiga siamensis* Nootpand, 1971	Eyed cat snake	Southeast and northeast	Mixed evergreen forests
28	*Boiga trigonata* (Schneider, 1802)	Common cat snake	Northwest, north-central, west-central, and southwest	Well-vegetated areas of plain lands
29	*Chrysopelea ornata* (Shaw, 1802)	Ornate flying snake	Countrywide	Forests and well-vegetated areas

SL	Scientific name	Common name	Distribution	Habitat preference
30	*Coelognathus helena* (Daudin, 1803)	Common trinket snake	Southeast, east-central, west-central, south-central, north, and southwest	Forests and well-vegetated areas
31	*Coelognathus radiatus* (Boie, 1827)	Copper-headed trinket snake	Countrywide	All terrestrial habitats, including human habitations
32	*Dendrelaphis cyanochloris* (Wall, 1921)	Wall's bronzeback	Southeast and northeast	Mixed evergreen forests
33	*Dendrelaphis proarchos* (Wall, 1909)	Eastern bronzeback	Countrywide	Forests and well-vegetated areas
34	*Dendrelaphis tristis* (Daudin, 1803)	Common Bronzeback	Countrywide	Forests and well-vegetated areas
35	*Lycodon aulicus* (Linnaeus, 1758)	Common wolf snake	Countrywide	All terrestrial habitats, including human habitations
36	*Lycodon jara* (Shaw, 1802)	Twin-spotted wolf snake	Countrywide	Forests and well-vegetated areas
37	*Lycodon zawi* Slowinski et al., 2001	Zaw's wolf snake	Southeast and northeast	Mixed evergreen forests
38	*Oligodon albocinctus* (Cantor, 1839)	Light-barred kukri snake	Southeast, northeast, and north	Forests and well-vegetated areas
39	*Oligodon arnensis* (Shaw, 1802)	Banded kukri snake	North, northeast, northwest, and southwest	Forests and well-vegetated areas
40	*Oligodon cinereus* (Günther, 1864)	Ashy kukri snake	Southeast and northeast	Mixed evergreen forests
41	*Oligodon cyclurus* (Cantor, 1839)	Cantor's kukri snake	Southeast, northeast, east-central, north-central, and north	Forests and well-vegetated areas
42	*Oligodon dorsalis* (Gray, 1834)	Bengalese kukri snake	Southeast and northeast	Mixed evergreen forests
43	*Oligodon taeniolatus* (Jerdon, 1853)	Streaked kukri snake	Northeast	Mixed evergreen forests
44	*Oligodon kheriensis* Acharji & Ray, 1936	Coral red kukri snake	North	Well-vegetated areas
45	*Oreocryptophis porphyraceus* (Cantor, 1839)	Black-banded trinket snake	Southeast and northeast	Mixed evergreen forests
46	*Psammodynastes pulverulentus* (H. Boie *in* F. Boie, 1827)	Common mock viper	Southeast, northeast, and northwest	Forests and well-vegetated areas
47	*Ptyas korros* (Schlegel, 1837)	Indochinese rat snake	Southeast, northeast, and southwest	Mixed evergreen and mangrove forests
48	*Ptyas mucosa* (Linnaeus, 1758)	Oriental rat snake	Countrywide	A wide range of habitats, including human habitations
49	*Ptyas nigromarginata* (Blyth, 1855)	Green rat snake	Southeast	Mixed evergreen forests
Family: Calamariidae				
50	*Calamaria pavimentata* Duméril, Bibron & Duméril, 1854	Collared reed snake	Southeast	Mixed evergreen forests
Family: Natricidae				
51	*Amphiesma stolatum* (Linnaeus, 1758)	Buff-striped keelback	Countrywide	Wide range of habitats
52	*Blythia reticulata* (Blyth, 1855)	Blyth's reticulated snake	Northeast	Mixed evergreen forests
53	*Atretium schistosum* (Daudin, 1803)	Olive keelback	Countrywide	Wetlands and low plains
54	*Fowlea flavipunctata* (Hallowell, 1860)	Yellow-spotted keelback	Southeast and north-central	Wetlands of hilly areas
55	*Fowlea piscator* (Schneider, 1799)	Checkered keelback	Countrywide	Wide range of habitats
56	*Fowlea schnurrenbergeri* (Kramer, 1977)	Bar-necked keelback	Southeast, northeast, east-central, south-central, northwest, and southwest	Wetlands
57	*Herpetoreas xenura* (Wall, 1907)	Cherrapunji keelback	Southeast and northeast	Mixed evergreen forests
58	*Rhabdophis helleri* (Schmidt, 1925)	Heller's red-necked keelback	Southeast, northeast, north-central, and east-central	Mixed evergreen and deciduous forests
59	*Rhabdophis himalayanus* (Günther, 1864)	Orange-collared keelback	Northeast	Mixed evergreen forests
60	*Smithophis atemporalis* Giri et al., 2019	Mizo rain snake	Southeast	Mixed evergreen forests
61	*Smithophis bicolor* (Blyth, 1855)	Two-colored forest snake	Southeast	Mixed evergreen forests
62	*Xenochrophis cerasogaster* (Cantor, 1839)	Painted keelback	Countrywide	Wetlands
Family: Sibynophiidae				
63	*Sibynophis collaris* (Gray, 1853)	Mountain many-tooth snake	Southeast and northeast	Mixed evergreen forests
64	*Sibynophis sagittarius* (Cantor, 1839)	Cantor's black-headed snake	Northwest	Well-vegetated areas
Family: Pseudoxenodontidae				
65	*Pseudoxenodon macrops* (Blyth, 1855)	Large-eyed false cobra	Southeast	Mixed evergreen forests
Family: Psammophiidae				
66	*Psammophis condanarus* (Merrem, 1820)	Condanarous sand racer	Southeast and northwest	Wetlands

SL	Scientific name	Common name	Distribution	Habitat preference
Family: Elapidae (Elapinae)				
67	*Bungarus caeruleus* (Schneider, 1801)	Common krait	Countrywide	Wide range of terrestrial habitats, including human habitations
68	*Bungarus fasciatus* (Schneider, 1801)	Banded krait	Countrywide	Wide range of habitats
69	*Bungarus lividus* Cantor, 1839	Lesser black krait	North, northwest, north-central, west-central, east-central, southeast, southwest, and south-central	Wide range of terrestrial habitats in plains
70	*Bungarus niger* Wall, 1908	Greater black krait	Southeast, northeast, and southwest	Mixed evergreen and mangrove forests
71	*Bungarus walli* Wall, 1907	Wall's krait	Countrywide	Wide range of terrestrial habitats in plains
72	*Calliophis melanurus* (Shaw, 1802)	Slender coral snake	Southeast	Mixed evergreen forests
73	*Naja kaouthia* Lesson, 1831	Monocled cobra	Countrywide	Wide range of habitats
74	*Naja naja* (Linnaeus, 1758)	Spectacled cobra	Countrywide	Wide range of habitats in plains
75	*Ophiophagus hannah* (Cantor, 1836)	King cobra	Southeast, northeast, and southwest	Mixed evergreen and mangrove forests
76	*Sinomicrurus macclellandi* (Reinhardt, 1844)	MacClelland's coral snake	Southeast, northeast, and southwest	Mixed evergreen and mangrove forests
Family: Elapidae (Hydrophiinae)				
77	*Hydrophis caerulescens* (Shaw, 1802)	Dwarf sea snake	Southeast	Coastal areas
78	*Hydrophis cantoris* Günther, 1864	Cantor's narrow-headed sea snake	Southwest	Mangroves of coastal areas
79	*Hydrophis curtus* (Shaw, 1802)	Spine-bellied Sea snake	Southeast	Coastal areas
80	*Hydrophis cyanocinctus* Daudin, 1803	Annulated sea snake	Southeast and southwest	Coastal areas
81	*Hydrophis fasciatus* (Schneider, 1799)	Stripped sea snake	Southeast	Coastal areas
82	*Hydrophis lapemoides* (Gray, 1849)	Persian Gulf sea snake	Southeast	Coastal areas
83	*Hydrophis nigrocinctus* Daudin, 1803	Black-headed sea snake	Southwest	Mangroves of coastal areas
84	*Hydrophis obscurus* Daudin, 1803	Russell's sea snake	Southeast and southwest	Coastal areas
85	*Hydrophis platurus* (Linnaeus, 1766)	Yellow-bellied sea snake	Southeast, south-central, and southwest	Coastal areas
86	*Hydrophis schistosus* Daudin, 1803	Hook-nosed sea snake	Southeast and southwest	Coastal areas
87	*Hydrophis stricticollis* Günther, 1864	Collared sea snake	Southeast	Coastal areas
88	*Laticauda laticaudata* (Linnaeus, 1758)	Blue-banded sea krait	Southeast	Coastal areas
89	*Microcephalophis gracilis* (Shaw, 1802)	Graceful small-headed sea snake	Southeast and southwest	Coastal areas

Table 2. List of regionally extinct species of snakes from Bangladesh.

SL	Scientific name	Common name	Justification
Family: Acrochordidae			
1	*Acrochordus granulatus* (Schneider, 1799)	Marine file snake	The most recent documented sighting of this species in Bangladesh dates back to 1970 in the Sundarbans (Khan 1987), after which no specimens or sightings have been documented.
Family: Homalopsidae			
2	*Dieurostus dussumieri* (Duméril et al., 1854)	Kerala mud snake	The holotype of this specimen was collected from 'Bengal' and designated as *Eurostus dussumieri*, but it was lost or destroyed during World War II (Das et al. 1998). Since then, there has been no documented record of this species in Bangladesh, and it is currently considered endemic to Kerala, India.
Family: Colubridae			
3	*Boiga westermanni* (Reinhardt, 1863)	Indian egg-eating snake	The holotype of this species was recorded from 'Rungpore, Bengal' and designated as *Elachistodon westermanni* in 1863 (Wallach et al. 2014). Since then, there has been no documented record of this species in Bangladesh.

Species richness

The species richness map reveals that mixed evergreen forests in the southeastern and northeastern parts (Chattogram and Sylhet regions, respectively), as well as mangrove forests in the southwestern parts of Bangladesh, exhibit the highest species richness (n > 6). The central, northwestern, and northern parts of the country show moderate species richness (n > 4) (Fig. 2A). Non-venomous species are most abundant in the mixed evergreen forests in the southeast and northeast, the deciduous forests of the east-central region, and the low-plain wetlands in the north and northwest (Fig. 2B). Venomous species are distributed fairly evenly across the country.

Table 3. The deleted snake species from the list of ophidian fauna of Bangladesh.

SL	Scientific name	Common name	Justification
Family: Typhlopidae			
1	*Xerotyphlops vermicularis* (Merrem, 1820)	Greek blind snake	This species was reported from Rangpur without a taxonomic specimen description (Kabir 2013). Previously, it was recorded in Southeastern Europe, Southwestern Asia, and Egypt (Wallach et al. 2014).
Family: Pareidae			
2	*Pareas margaritophorus* (Jan, 1866)	Mountain slug snake	This species was listed without a specimen record or taxonomic description (Asmat and Hannan 2007). To date, it has been reported from Southeast Asia (Wallach et al. 2014).
Family: Homalopsidae			
3	*Homalopsis buccata* (Linnaeus, 1758)	Masked water snake	This species was listed without a specimen record, whereas the wetlands of Northeast Bangladesh were mentioned as its habitat (Khan 2015). However, it was previously reported from Southeast Asia (Wallach et al. 2014).
Family: Viperidae			
4	*Echis carinatus* (Schneider, 1801)	Saw-scaled viper	In 1987, this species was believed to be present in Bangladesh (Khan 1987). Later, it was added to the country's species list (Asmat and Hannan 2007) without a specimen record or confirmed sighting.
5	*Trimeresurus albolabris* Gray, 1842	White-lipped green pit viper	It was once considered the most abundant pit viper in Bangladesh. However, recent studies have shown that *T. albolabris* is not expected to occur in the Indian subcontinent (Vogel et al. 2022) or in Bangladesh (Haidar et al. 2023).
6	*Trimeresurus purpureomaculatus* (Gray, 1832)	Mangrove pit viper	*T. purpureomaculatus* has been listed for Bangladesh without confirmed records (Asmat and Hannan 2007; Khan 2010); verified occurrences are from southern Myanmar (Yangon and Ayeyarwady regions), Thailand, and Singapore (Chan et al. 2023).
7	*Trimeresurus stejnegeri* Schmidt, 1925	Chinese green pit viper	*T. stejnegeri* was listed in Bangladesh without confirmed records (Asmat and Hannan 2007) and does not occur west of Yunnan Province, China (David et al. 2002). Reports from India based on BMNH specimens (Malhotra and Thorpe 2004) were later re-identified as *T. gumprechti*, confirming that *T. stejnegeri* does not occur in India (David and Mathew 2005). Therefore, we clarify that this species is also not found in Bangladesh.
Family: Colubridae			
8	*Ahaetulla nasuta* (Lacépède, 1789)	Long-nosed vine snake	It was previously reported to occur throughout Bangladesh (IUCN Bangladesh 2015); however, its distribution was mentioned as being limited to the western part of the country (Khan 2015; Khan 2018). Recent studies have confirmed that *A. nasuta* is endemic to Sri Lanka and does not occur in Bangladesh (David et al. 2021).
9	*Ahaetulla pulverulenta* (Duméril et al., 1854)	Brown-speckled vine snake	It was documented in the Sundarbans (Denzau and Denzau 2010). Later, *A. pulverulenta* was found to be restricted to Sri Lanka, and populations on the Indian mainland were assigned to *A. sahyadrensis* (Mallik et al. 2020).
10	*Boiga cynodon* (Boie, 1827)	Dog-toothed cat snake	A specimen of *Boiga* in the Museum of the Department of Zoology, University of Chittagong, was tagged as *B. cynodon* following Nootpand's (1971) description and depiction of *B. cynodon siamensis* (Ahsan et al. 2015). However, taxonomic revision clarified that *B. siamensis* is widely distributed across Bangladesh, India, Myanmar, Thailand, Cambodia, Laos, and Vietnam, while *B. cynodon* is restricted to southern regions, including Thailand, Malaysia, Indonesia, and the Philippines (Pauwels et al. 2004).
11	*Dendrelaphis pictus* (Gmelin, 1789)	Painted Bronzeback	The population in Bangladesh was previously assigned to *D. pictus*. However, the Indochinese populations, including those in Bangladesh, have since been reassigned to *D. proarchos* (Vogel and van Rooijen 2011).
12	*Dendrelaphis punctulatus* (Gray, 1826)	Green tree snake	This species was assumed to be found in Bangladesh (Khan 2015), although its global distribution is confined to the Australian continent and eastern Indonesia (Wallach et al. 2014).
Family: Natricidae			
13	*Hebius venningi* (Wall, 1910)	Chin hills keelback	*H. venningi* was reported from Bangladesh by Reza (2010b); however, photographs and morphological data have been re-examined and indicate that the specimen was *H. xenura* (David et al. 2015).
14	*Herpetoreas sieboldii* Günther, 1860	Sikkim Keelback	This species was listed in Bangladesh without confirmed records (Khan 2015); however, it was previously reported from the extremely high elevation above 1100 msl (van Nguyen et al. 2024).
15	*Rhabdophis subminiatus* (Schlegel, 1837)	Red-necked keelback	The population of the subspecies in Bangladesh was assigned to *R. subminiatus helleri*, which has now been elevated to a full species, *R. helleri* (Liu et al. 2021).
Family: Sibynophiidae			
16	*Sibynophis subpunctatus* Duméril et al., 1854	Duméril's Black-headed Snake	This species was assumed to be found in southwestern Bangladesh (Khan 1982, 1987, 1992, 2015), although its geographic range is confined to southern India and Sri Lanka (Maheta et al. 2023).

Table 4. List of snake species expected to be found in Bangladesh.

SL	Scientific name	Common name	Global distribution
Family: Typhlopidae			
1	*Grypotyphlops acutus* (Duméril & Bibron, 1844)	Beaked blind snake	India
Family: Xenodermidae			
2	*Stoliczkia khasiensis* Jerdon, 1870	Khasi earth snake	India
Family: Pareidae			
3	*Pareas macularius* Theobald, 1868	Mountain slug snake	India, China, Myanmar, Thailand, Laos, and Vietnam
Family: Homalopsidae			
4	*Cantoria violacea* Girard, 1858	Cantor's water snake	India, Myanmar, Thailand, Malaysia, Singapore, and Indonesia
Family: Viperidae			
5	*Craspedocephalus gramineus* (Shaw, 1802)	Bamboo pit viper	India
6	*Ovophis monticola* (Günther, 1864)	Mountain pit viper	India, Nepal, Myanmar, and China (Xizang Province)
7	*Protobothrops jerdonii* (Günther, 1875)	Jerdon's pit viper	India, Bhutan, Myanmar, China, and Vietnam
8	*Protobothrops mucrosquamatus* (Cantor, 1839)	Brown-spotted pit viper	India, Myanmar, China, Taiwan, Laos, Vietnam, and Thailand
Family: Colubridae			
9	*Elaphe cantoris* (Boulenger, 1894)	Eastern trinket snake	India, Nepal, Bhutan, and Myanmar
10	*Elaphe hodgsoni* (Günther, 1860)	Hodgson's trinket snake	India, China, and Nepal
11	*Elaphe taeniurus* Cope, 1861	Beauty snake	India, China, Japan, Bhutan, Myanmar, Laos, Cambodia, Thailand, Vietnam, Malaysia, Brunei, and Indonesia
12	*Gonyosoma frenatum* (Gray, 1853)	Khasi hills trinket snake	India, China, and Vietnam
13	*Gonyosoma prasinum* (Blyth, 1855)	Green trinket snake	India, Bhutan, Myanmar, and possibly eastern Nepal
14	*Liopeltis calamaria* (Günther, 1858)	Calamaria reed snake	India, Nepal, and Sri Lanka
15	*Liopeltis frenata* (Günther, 1858)	Günther's reed snake	India, China, Myanmar, Laos, and Vietnam
16	*Lycodon fasciatus* (Anderson, 1879)	Banded wolf snake	India, China, Bhutan, Myanmar, Thailand, Laos, and Vietnam
17	*Lycodon septentrionalis* (Günther, 1875)	White-banded wolf snake	India, Bhutan, China, Myanmar, Thailand, Cambodia, Laos, and Vietnam
18	*Oligodon catenatus* (Blyth, 1855)	Assam kukri snake	India, China, Myanmar, Cambodia, Vietnam, Thailand, and Laos
19	*Oligodon theobaldi* (Günther, 1868)	Theobald's Kukri Snake	India, Myanmar, and Thailand
Family: Natricidae			
20	*Hebius parallelus* (Boulenger, 1890)	Parallel-striped keelback	India
21	*Hebius modestus* (Günther, 1875)	Modest keelback	India, China, and Myanmar
22	*Hebius khasiensis* (Boulenger, 1890)	Khasi hills keelback	India and western Myanmar
23	*Herpetoreas pealii* (Sclater, 1891)	Assam keelback	India
24	*Herpetoreas platyceps* (Blyth, 1855)	Himalayan keelback	India, China, Nepal, Bhutan, and Pakistan
25	*Rhabdophis plumbicolor* (Cantor, 1839)	Green keelback	India, Pakistan, Myanmar, and Sri Lanka
26	*Trachischium fuscum* (Blyth, 1855)	Blackbelly worm-eating snake	India, Pakistan, Nepal, Bhutan, and Myanmar
27	*Trachischium guentheri* Boulenger, 1890	Rosebelly worm-eating snake	India, China, Nepal, and Bhutan
28	*Trachischium monticola* (Cantor, 1839)	Mountain worm-eating snake	India and China
29	*Trachischium tenuiceps* (Blyth, 1855)	Yellowbelly worm-eating snake	India, Nepal, Bhutan, and China
Family: Elapidae (Elapinae)			
30	*Bungarus bungaroides* (Cantor, 1839)	Northeastern hill krait	India, Nepal, Bhutan, China, Myanmar, and N Vietnam
Family: Elapidae (Hydrophiinae)			
31	*Hydrophis ornatus* (Gray, 1842)	Ornate Reef Sea Snake	Kuwait, Iran, Saudi Arabia, Bahrain, United Arab Emirates, Oman, Pakistan, India, Sri Lanka, Myanmar, Thailand, Vietnam, China, Taiwan, Japan, the Philippines, Malaysia, Indonesia, Papua New Guinea, Australia, New Caledonia, and Kiribati
32	*Hydrophis stokesii* (Gray, 1846)	Stokes' Sea Snake	India, Pakistan, Sri Lanka, Thailand, Vietnam, China, Taiwan, Malaysia, Singapore, the Philippines, Indonesia, Papua New Guinea, and Australia
33	*Laticauda colubrina* (Schneider, 1799)	Yellow-lipped sea krait	India, Myanmar, Thailand, Vietnam, Malaysia, Singapore, Brunei, Indonesia, Timor-Leste, the Philippines, Papua New Guinea, the Solomon Islands, Vanuatu, New Caledonia, the Loyalty Islands, Australia, Japan, Taiwan, Palau, the Carolines, Samoa, Fiji, and Tonga

However, areas in the southeastern, northeastern, south-central, southwestern, east-central, northwestern, and northern regions demonstrate higher species richness ($n > 4$). These areas include the mixed evergreen forests of the Chattogram and Sylhet regions, the mangrove forests of the Sundarbans, the deciduous forests of the plains, and the low-plain wetlands (Fig. 2C).

Kernel density estimation of species abundance

Kernel density estimation (KDE) analysis shows that the southeastern and northeastern parts of Bangladesh, particularly the mixed evergreen forests of the greater Sylhet and Chattogram divisions, have the highest probability of species abundance ($p > 0.2$ to 0.3) for all confirmed species ($n = 89$) (Fig. 3A). The deciduous forests in the east-central region, the mangrove forests of the Sundarbans in the southwest, and the plain wetlands in the northwest form low-probability zones ($p > 0.1$). In contrast, the northern region has the least potential for the existence of snakes ($p < 0.1$). Non-venomous snakes are most likely to be abundant in the mixed evergreen forests of the southeast and northeast with high probability values ($p > 0.3$), with moderate probabilities ($p > 0.1$) found in the central regions (Fig. 3B). Similarly, the southeastern and northeastern parts of Bangladesh, with probability values greater than 0.1, are likely hotspot areas for venomous snakes ($n = 27$). Furthermore, the deciduous forests of the east-central region and the low-plain wetlands of the northwestern region, particularly around the banks of the Padma, Meghna, and Jamuna rivers, represent moderate-probability zones for venomous snake species ($p > 0.05$). The southeastern coastal region, in particular, shows a high potential ($p > 0.05$) for venomous sea snakes (Fig. 3C). Overall, the mixed evergreen forests of the southeast and northeast have been recognized as the most suitable habitats for ophidian diversity in the country across all categories of snakes (venomous and non-venomous).

Discussion

This systematic review and analysis of ophidian species in Bangladesh provides an updated and comprehensive overview of the species diversity and distribution patterns of snakes in the country, highlighting significant regions that need to be conserved as habitats. This study reveals Bangladesh as home to diverse ophidian fauna, confirming the presence of 89 snake species and emphasizing the importance of specimen-based taxonomic research to discover more species. Therefore, species eliminations from the country list underscore the significance of continuous taxonomic revision and reassessment of snake specimens. Additionally, habitat-specific distribution patterns of venomous and non-venomous snakes indicate the potential of habitat diversity in the country for *in situ* conservation.

The predominance of non-venomous species aligns with findings from other tropical regions, both in terms of diversity and population density (Luiselli et al. 2020). The families Colubridae and Natricidae account for the largest proportion of non-venomous species diversity. Additionally, the families Typhlopidae, Pythonidae, Sibynophiidae, Erycidae, Pareidae, and Calamariidae are entirely comprised of non-venomous snakes. Two venomous families, Elapidae and Viperidae, constitute 29.2% of the total snake species. The Elapidae family is the most significant contributor to the venomous species pool, with both terrestrial and marine species (Chippaux 2017). The Viperidae family consists of all terrestrial venomous snakes, found in habitats ranging from lowland mangroves to high-elevation hills (Maritz et al. 2016). In addition to these venomous families, the Natricidae family includes a single species known for being rear-fanged

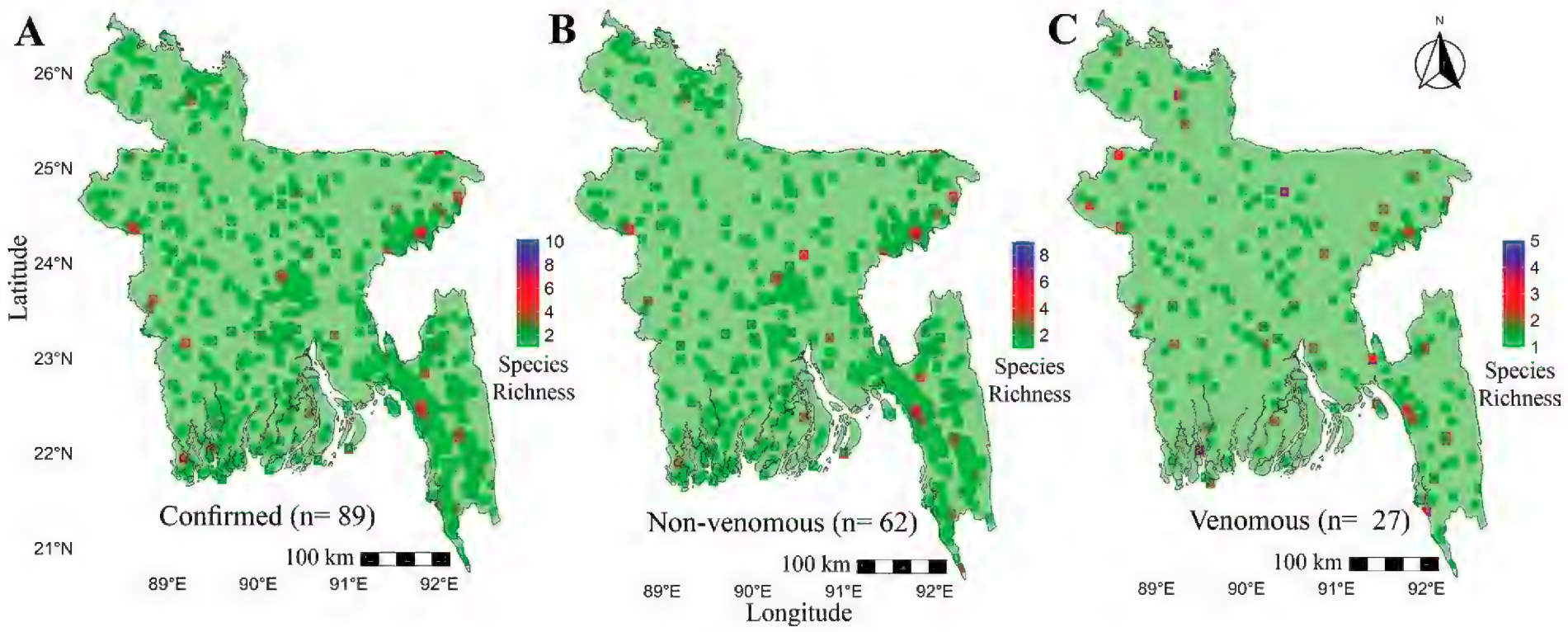

Figure 2. Species richness map of the snakes of Bangladesh. **A.** All confirmed snake species (n = 89), representing the combined distribution of venomous and non-venomous species; **B.** Non-venomous snakes (n = 62); and **C.** Venomous snakes (n = 27).

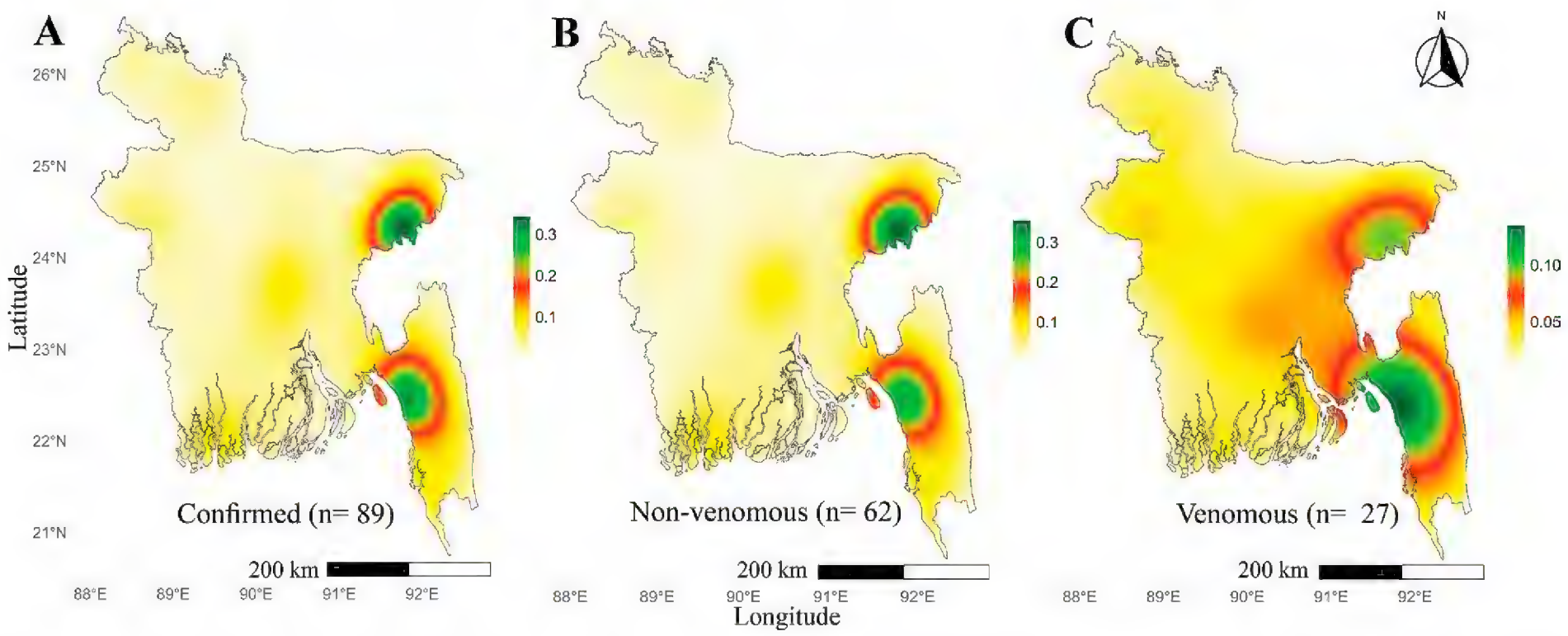

Figure 3. Probability distribution maps of snake occurrence in Bangladesh using kernel density estimation (KDE), illustrating areas with varying probabilities of occurrence, from low to high, for different snake categories. **A.** All confirmed snake species (n = 89; no. of observations = 1768), representing the combined distribution of venomous and non-venomous species; **B.** Non-venomous snakes (n = 62; no. of observations = 1322); and **C.** Venomous snakes (n = 27; no. of observations = 443), highlighting regions with the highest possibility of encountering medically significant snakes.

venomous, with a poison gland located behind the eye (David and Vogel 2021).

This study also identifies three species (*Acrochordus granulatus*, *Dieurostus dussumieri*, and *Boiga westermanni*) as regionally extinct in Bangladesh. The most recent confirmed sighting of the marine file snake, *A. granulatus*, was in 1970 (Khan 1987). Since then, no further records of this species have been reported. The holotype of the Kerala mud snake, *D. dussumieri*, was collected from "Bengal" and designated as *Eurostus dussumieri* but was lost or destroyed during World War II (Das et al. 1998). There have been no subsequent records of this species in Bangladesh, and it is now considered endemic to Kerala, India (Kumar et al. 2012). Similarly, the holotype of the Indian egg-eating snake, *B. westermanni*, was collected from Rangpur in 1863 and originally designated as *Elachistodon westermanni* (Wallach et al. 2014). However, there have been no further confirmed sightings of this species in Bangladesh since that time. The absence of these species may reflect changes in habitat suitability, climate shifts, or anthropogenic pressures, underscoring the importance of long-term monitoring and the need for conservation actions to mitigate further losses.

Furthermore, 16 species have been removed from the country's snake list. Nine species—*Xerotyphlops vermicularis*, *Pareas margaritophorus*, *Homalopsis buccata*, *Echis carinatus*, *Trimeresurus purpureomaculatus*, *T. stejnegeri*, *Dendrelaphis punctulatus*, *Herpetoreas sieboldii*, and *Sibynophis subpunctatus*—were originally listed without specimen-based documentation or confirmed sightings and have thus been excluded. Four species have been eliminated based on taxonomic revisions. For example, *Trimeresurus albolabris*, once considered the most abundant pit viper in Bangladesh, is now believed to be absent in the Indian subcontinent, including Bangladesh. In these regions, it may be replaced by *Trimeresurus salazar* (Vogel et al. 2022; Haidar et al. 2023). Similarly, the long-nosed vine snake, *Ahaetulla nasuta*, once thought to be widely distributed in Bangladesh (IUCN Bangladesh 2015), is now confirmed to be endemic to Sri Lanka (David et al. 2021). The brown vine snake, *Ahaetulla pulverulenta*, recorded from the Sundarbans (Denzau and Denzau 2010), has since been reassigned to *A. sahyadrensis* (Mallik et al. 2020). The population of *Dendrelaphis pictus* in Bangladesh has been revised as *D. proarchos* (Vogel and van Rooijen 2011). A specimen of *Boiga* from the University of Chittagong Museum was initially tagged as *B. cynodon* (Nootpand 1971). Later taxonomic revision clarified the distribution of *B. siamensis* in Bangladesh, India, Myanmar, Thailand, Cambodia, Laos, and Vietnam, while *B. cynodon* is restricted to Thailand, Malaysia, Indonesia, and the Philippines (Pauwels et al. 2004). The Chin Hills keelback, *H. venningi*, was reported from Bangladesh by Reza (2010b); however, re-examination of photographs and morphological data confirmed the specimen as *H. xenura*. Consequently, there is no confirmed record of *H. venningi* from Bangladesh, and the species is restricted to northeastern India and western to northwestern Myanmar (David et al. 2015). Lastly, the population of *Rhabdophis subminiatus helleri* in Bangladesh has been elevated to full species status and is now recognized as *R. helleri* (David and Vogel 2021). Revising species lists by removing unconfirmed species and reassessing taxon status contributes to accurate and reliable inventories, which are essential for proper conservation planning to protect biodiversity.

The species richness map and KDE analyses revealed specific regions of Bangladesh that are particularly important for snake diversity. The southeastern and northeastern regions, characterized by mixed evergreen forests in Chattogram and Sylhet, emerge as hotspots for ophidian diversity. In addition, the southwestern mangrove forests and central deciduous forests are considered regions of

abundance for non-venomous species. These areas are critical conservation zones with high species richness and potential species abundance. The presence of terrestrial venomous species in mixed evergreen forests, deciduous forests, and lowland wetlands highlights the ecological significance of these habitats. Alternatively, the southeastern seashore and coastal mangrove forests had higher probability values for the occurrence of marine venomous snakes. These coastal areas represent critical marine habitats that require high conservation attention given threats from fishing, trawling, vehicle traffic, and habitat destruction (Udyawer et al. 2018).

Beyond their ecological role in maintaining ecosystem balance, venomous snakes have significant medical importance, particularly in snakebite management. Bangladesh is recognized as one of the most snakebite-prone countries globally, largely due to its diverse ecosystems that harbor a variety of venomous species (Ghose and Faiz 2014). Identifying regions with high richness of venomous snake species is critical, as this knowledge can inform effective management strategies for both the conservation of these species and the mitigation of public health concerns associated with snakebites (Haidar et al. 2023). Such information is invaluable for developing targeted interventions in snakebite prevention, as well as enhancing both preclinical management and clinical treatment. Understanding the distribution patterns, regional diversity, and abundance of these snakes allows healthcare providers to better anticipate and respond to snakebite incidents, ensuring timely and appropriate medical care. Furthermore, insights into the venom composition of local species are essential for improving antivenom production and advancing treatments that can save lives in areas where snakebites are a common threat (WHO 2016).

Considering the significant habitat-specific variation in species richness and distribution, conservation efforts should be prioritized for protecting regions with high species diversity. Particularly, the mixed evergreen forests in the southeastern and northeastern parts of the country are at high risk of habitat destruction (Reza and Hasan 2019). Moreover, the analysis suggests that regions such as the Sundarbans mangrove forests and coastal wetlands are critical areas for marine venomous species, which face high risk from anthropogenic activities and natural calamities, including climate change (Mahendra 1935). Conservation strategies should also account for species that may inhabit Bangladesh but have not yet been confirmed through direct sightings or specimen-based documentation. Their inclusion in the anticipated species list suggests that further exploration of their potential habitats is warranted.

Conclusion

This research provides detailed data on the ophidian fauna of Bangladesh, revealing species distribution patterns and potential areas for conservation priority. The incorporation of the latest taxonomic revisions, identification of regional extinctions, and anticipation of future species occurrences highlight the dynamic state of the country's snake diversity. This study underscores the importance of maintaining diverse ecosystems, particularly semi-evergreen rainforests in the southeast and northeast, coastal mangrove forests in the southwest, deciduous forests in the east-central region, and low-plain wetlands in the northwest, as key snake habitats. Our findings enhance the understanding of the ecological requirements of snakes and provide a foundation for future ecological research and conservation initiatives aimed at protecting the country's ophidian fauna.

Acknowledgements

We are grateful to the diligent researchers, wildlife biologists, and enthusiastic field herpetologists who have significantly contributed to the herpetology of Bangladesh. Their knowledge of snake identification and documentation of new country records from various geographical regions of Bangladesh has aided in assembling a comprehensive and authenticated checklist of the country's snake fauna. We are also thankful to the social media groups working to create public awareness about snakes and for providing geographical locations of encountered snakes to help mitigate snake–human conflict nationwide. Their rapid response to rescue operations reduces snake–human conflict and supports the conservation of snakes throughout Bangladesh.

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Supplementary material 1

Literature Survey on Snakes of Bangladesh (1853–2024)

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Data type: xlsx

Explanation note: A total of 227 publications on the snakes of Bangladesh, published between 1853 and 2024, were analyzed to extract information on the snake taxa, along with the most precise locality data within Bangladesh. These included 190 research articles, 31 books or book chapters, two conference proceedings, and four institutional reports.

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